



AMERICA'S DIGITAL SCHOOLS 2006

A FIVE-YEAR FORECAST

Mobilizing the Curriculum

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“We believe this study has the potential to influence policy decisions and initiate the kind of in-depth discussions we need to have if we are to move forward in closing our achievement gap with other nations.”

Arnie Glassberg, Superintendent, San Lorenzo School District, CA

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Key Findings

Key Trends

Digital Schools Are Transitioning From a Desktop World to a Mobile World

Not long ago very few schools had a large number of laptop computers. *ADS 2006* indicates that 19% of all student devices today are mobile and that 50% will be mobile in 2011. It is noteworthy that schools rarely change at this rapid rate. Also, since these figures represent the installed base, current-year sales numbers will be even more tilted toward mobile solutions. New technologies have emerged as drivers for this shift. An example is the reuse of the LCD panel in consumer portable DVD players, which cuts the cost of the display, the most expensive item in the system, by more than half. Leading the way in driving lower-cost devices are the work by Negroponte at MIT, the Dana from Renaissance Learning, the Intel Eduwise laptop, the Nova5000 from Fourier Systems, and the Microsoft Ultra-Mobile PC.

A number of recent developments could be helping to fuel the growth in 1:1 programs. Early research into their effectiveness appears promising, though experts caution that further study is needed. Districts and states report higher attendance rates, fewer discipline problems, and improved writing skills. After years of budget deficits, the fiscal climate in many states is improving, [and] education leaders are looking for ways to better engage students and make their school experience more relevant to the 21st century. Connecticut, Illinois, Massachusetts, New Hampshire, New Mexico, Pennsylvania, and South Dakota are among the many states that aim to follow Maine's and Michigan's lead. New options in 1:1 computing are expanding the choices. There are an increasing number of hybrid-style computing devices that give educators concerned about the cost of laptops or tablets—and the limited functionality of handhelds—new options.

From “1-to-1 computing on the rise in schools,” *eSchool News* online, May 2006.

Ubiquitous Computing Is Growing Rapidly

Closely connected to the above is the move toward ubiquitous, or 1:1, computing (defined as “each student and teacher has one Internet-connected wireless computing device for use both in the classroom and at home”). Ubiquitous computing, where every teacher and student has his or her own computing device that is not shared with others, is very different from temporary 1:1 solutions, such as those provided by computer carts.

In 2003, QED reported that 4% of U.S. school districts had started 1:1 implementations. *ADS 2006* indicates that more than 24% of school districts are in the process of transitioning to 1:1—a large jump in a market that is known to take a cautious view of change.

Ubiquitous Computing Practitioners Report Substantial Academic Improvement

ADS 2006 shows that 88% of school districts where academic results were tracked report moderate to significant positive results, with 12% reporting no results or poor results. It appears that properly implemented ubiquitous computing solutions can help improve student achievement to a significant degree.

In related interviews, many educators have pointed out that the effects of ubiquitous computing extend beyond improved high-stakes test results. Other widely observed effects include a reduction in dropout rates and an improvement in attendance rates.

Michigan's Freedom to Learn initiative, which had supplied laptops to nearly 21,000 students across 95 school districts by last fall, has led to more independent research and student discussion in classrooms, according to an evaluation conducted last spring. Nearly nine out of ten students say they're glad to have laptops, and the same percentage of lead teachers say the program has increased student motivation.

"Usually such overwhelmingly positive results as these aren't seen for three or four years out. Clearly, our 1:1 computing program is doing what it is designed to do for our school children—enhance student learning and achievement in core academic subjects." Bruce Montgomery, Director, Michigan Freedom to Learn 1:1 Program.

From "1-to-1 computing on the rise in schools," *eSchoolNews* online, May 2006.

A Bandwidth Crisis Is Looming

Today the Internet bandwidth per student is 2.90 Kbps (or kilobits per second per student) according to the survey. Furthermore, schools say they will grow this to 9.57 Kbps per student by 2011—a 3.3-fold increase. But the *ADS 2006* team believes that as much as 40 Kbps may be needed in five years. As the number of computers in schools increases and the ways in which students use computers change, more and more bandwidth will be needed.

It is unlikely, however, that many schools are budgeting for a 14-fold increase, although technology directors are generally aware of the challenge. The hard costs of the bandwidth required to support the growth in online learning, home connectivity, and ubiquitous computing are unknown and likely to require additional research.

Please see Appendix B for an in-depth examination of this topic.

Online Learning Is Growing

ADS 2006 shows that online learning in the eight main subject areas is currently used by only 3.8% of students. By 2011 this figure will grow to 15.6% or a 32.6% compound annual growth rate.

This finding has substantial implications across the school landscape. If over 8 million students are taking an online course in 2011, then schools will need to purchase new materials, train teachers to work in the new environment, and upgrade their infrastructure to handle the increased demand while improving specialized instruction.

Professional Development Is Key

ADS 2006 indicates that only 17% of district curriculum directors believe that their current professional development program is prepared to support 1:1 computing effectively. In contrast, 73% of superintendents rank professional development as extremely important in successful 1:1 computing initiatives.

For the first time, districts have quantified the professional development required for a successful 1:1 implementation. The average is \$94.75 per student per year. This is a substantial amount. However, it is consistent with anecdotal evidence of what works.

Professional development is perhaps the single largest factor in the success or failure of the digital school. To be effective, professional development needs to include administrators and take different forms depending on the needs of the school or district. The focus needs to shift to a rigorous process of curriculum integration, data-driven decision making, and capacity building.

"Administrators are starting to realize that technical support and professional development are grossly undervalued," says [Tim Wiley, senior analyst at research firm Eduventures]. "The 1:1 programs that have been successful have made sure that quality control, data conversion, and professional development were taken slowly and done properly."

"Planning is crucial," says Calvin Baker, superintendent of the Vail School District (VSD) in Tucson. VSD is home to Empire High School, where each student has a laptop and access to digitized textbooks. Baker began professional development a year before school opened, focusing on a train-the-trainer model. "Teachers need to be part of the decisions and not have the solution dumped on them," says Baker.

From "Expert tips on how to approach professional development in laptop environments," by Chris Cutter, *Technology & Learning*, April 15, 2006.

Low Total Cost of Ownership Is Increasingly Important

According to *ADS 2006*, superintendents rank low total cost of ownership (TCO) as one of the most important factors in a successful ubiquitous computing implementation. While most technology directors agree, 24% feel TCO is only somewhat important, and 9% feel it is not important.

As districts consider moving toward a ubiquitous computing environment, TCO becomes increasingly important. When every student has a computer, every added dollar of support cost per computer becomes an added dollar per student, not 20 cents per student as in a 5:1 student/computer school environment.

Some Product Categories Will Grow at a Rapid Rate

ADS 2006 shows that student appliances, tablet computers, handheld devices, and interactive whiteboards will be some of the fastest-growing product categories among mainstream products over the next five years. The results show student appliances growing 104%, tablet computers 78%, handheld devices 37%, and interactive whiteboards 24%. The projected growth in mobile computing is also significant, with PC laptops growing at a 27% annual rate and Mac laptops at 25%. These growth rates, for products with fairly high price points, appear robust in a market known to approach change cautiously.

Key Findings by Respondent Group

Superintendents

- 31% of superintendents indicate that they are implementing a 1:1 solution in at least one grade. Since historically this figure has been around 4%, this finding represents a huge increase in 1:1 computing activity taking place today.
- Superintendents appear, in general, to support 1:1 computing. Over 75% agree or strongly agree with the premise that “ubiquitous technology can reduce the time, distance, and cost of delivering information directly to students and that teachers can spend substantially more one-on-one time with each student and personalize the education experience to each student’s needs.”
- Superintendents consider themselves important in raising funds for technology. 56% see themselves as responsible for raising funds. This may be because bond issues and other special funding mechanisms are used for major technology initiatives.
- Superintendents view school boards as the most supportive community group in terms of technology initiatives. 40% strongly agree and 96% agree in some manner that school boards are supportive.
- 59% of superintendents report that their community has passed a bond issue for education in the past three years, while 42% anticipate floating a new bond issue in the next three years.

In 1999, Michael Davino, now the Superintendent of Schools in Springfield, NJ and, at that time, Chief Administrator with the New York City Schools, was asked to redesign the program at the Petrides Education Complex in Staten Island. A decision was made to introduce 1:1 computing, first in the high school grades and later in the middle school grades—a total of over 800 laptops.

“We learned a lot,” said Michael. “We learned that it’s hard for some teachers to re-think their approach to test prep. We learned that middle school is the place to start because there’s less focus on test prep and the kids are so engaged. Our middle school students embraced the new technology with a passion, and when they moved on to high school, they took that passion with them. They became the driving force for change. Teachers sometimes think they have to know everything, but they don’t. They need to understand the power of the technology, and the kids will show them the details. This breaks down the digital divide between teachers and students and builds a new kind of interaction that’s highly beneficial. That’s why when I moved to Springfield, we started our program at the middle school level.”

“A wireless laptop program provides up-to-date information, access to virtual experiences, instant feedback, individualized attention for all learning styles, student independence, and constant practice. And it’s highly adaptable to individual, small group, or whole class instruction.” said Michael.

Curriculum Directors

- 66% of curriculum directors indicate that a bullet-proof infrastructure is the most important factor in adopting a primarily digital curriculum. This finding may indicate a level of skepticism about the current state of infrastructures.
- Almost the same number, 64%, of curriculum directors rank more flexible licensing and pricing terms and conditions as extremely important factors in adopting a primarily digital curriculum.
- Curriculum directors rank adherence to universal design principles, for greater accessibility for all students, as the top factor in successful digital learning.

- Curriculum directors indicate that they expect dollar expenditures for digital supplemental materials to triple over the next five years.
- Interestingly, only 27% of curriculum directors indicate that third party, web-delivered content via an ASP is an important factor in digital learning. It appears that those surveyed want a digital curriculum but that they prefer it to reside on their own server.
- Core courses are being offered via online learning almost as frequently as supplemental subjects, with vocational technology (91%) leading, followed by science and social studies in regular high school courses (78% and 76%, respectively). In AP courses, art and music (38%) are most frequently offered, with math and science close behind (35% and 31%, respectively).
- However, 7% of students are taking math courses via online learning, as are 6% of language arts students. These percentages may indicate the growth in use of online learning for alternative education students who are taking more core courses from home.
- With fewer than 40% of curriculum directors indicating that delivery on CD or DVD as well as the Internet is important, it appears that CDs may be truly falling out of favor.

We are a highly visual society. TV, computers, video games, and movies are part of everyday life from a very early age. Unlike any other time in history, children coming to school are acutely visually aware. The challenge for teachers is how to put this unique intelligence to work as a learning tool. One avenue that has great promise for teaching children to read is digital photography.

Imagine the power when a child can take a picture of a familiar object and label it with a new word. At Head Start, we are using digital photography and cutting-edge software, such as APTE's Photo Kit Junior, to create books, puppet shows, journals, and more. If you want a child to learn, personalize the content. And nothing makes learning more real and relevant than a picture book about your own pooch!

Val Price, Director, Office of Early Childhood Technology Coordinator, Chicago Public Schools.
Dave Roberts, Technology Consultant, Early Childhood, Chicago Public Schools.

Technology Directors

- Of those who track results, 88% report moderate to significant academic improvement from 1:1 computing. Districts that have not yet implemented 1:1 computing are twice as likely to attribute significant academic improvement to 1:1 computing.
- 22% of technology directors report that their evidence of improved academic performance comes from an independent rigorous evaluation by academic institutions. This is a significant percentage considering the relatively new focus on scientifically based results and the cost of independent evaluations.
- As schools expand their electronic services to students outside the school, effectively extending the school day, they are finding that home connectivity is an issue. The issue extends to the effort to provide electronic services to parents as well as students. Spending for home connectivity is currently the major unresolved issue for technology directors. However, a sizeable group does not plan to address it. Current and projected spending is far less than for other areas at \$32 million per year in 2006.
- Schools are looking for a “student appliance,” which is a new product category, to play a big role in their ubiquitous computing plans. Appendix A reviews the differences between these appliances and other student devices.

- Digital content is being funded by budget categories outside of the technology budget. 33% of technology directors report that 20% or more of their spending for digital content and curriculum comes from budgets other than the technology budget.
- Science probes and data logging are growing in popularity, with a 19.4% compound annual growth rate expected from 2006 to 2011. This is probably due to the increased national emphasis on science and math.
- Interactive whiteboards have come down in price and dramatically improved in functionality. Schools are finding the improvements in teacher productivity to be worth the investment. Sales are projected to double by 2008 and double again by 2011.
- Formative assessment software will take on a more important role in the classroom, driven by NCLB and data mining needs. Ubiquitous computing tremendously facilitates formative assessment, which is increasingly being bundled into curriculum programs. Projections for budgeted formative assessment software are growing at a compound annual growth rate of only 8.3% per year, although the 2006 budget is over \$350 million.
- TCO is important to technology directors as well as superintendents. Ubiquitous computing makes the focus on TCO mandatory. Fortunately, progress is being made in identifying the sources of TCO and addressing the real costs.
- Schools have been slow to adopt SIF, but it is now starting to become widespread. The NCLB statewide vertical reporting requirements featuring SIF will be a big driver for future growth.
- Open source is gaining importance for schools. The growth rate is a healthy 70% per year. Beyond Linux and the well-known Indiana open-source initiative, a number of other states and districts are considering open source. Moodle, a curriculum delivery platform, is an example of a popular open-source program. Widespread open-source usage will grow eight-fold from 2006 to 2011.
- There will be substantial growth in school Internet bandwidth needs that are not currently budgeted. This is a critical finding, since it affects every Internet application that schools use. See Appendix B for further exploration of this important issue.

Substantial experience reading complex texts in high school is a key indicator of college success, according to a new report entitled "Reading Between the Lines." Some educators have found solutions with the help of technology. At University High School in Orlando, FL, the graduation rate has risen from the mid-80s to 92 percent, and FCAT reading scores have registered significant learning gains for the lower 25 percent of students, pushing the school's state rating from a C to a high B. Principal David Christiansen attributes these gains in part to the use of Academy of Reading software from Autoskill, Inc.

Salt Lake Community College is one of many schools using Merit Software's reading programs to help students learn to understand complex texts. The software has "allowed us to add more reading to our curriculum without being overwhelmed," said Kathleen Johnston of the school's Reading and Learning Enhancement Department. Researchers at Marshall University monitored the progress of students at Calhoun Middle-High School in Mount Zion, WV, where the software was used for two years in a row. The lowest-achieving quartile of students there made greater test-score gains than students who did not use the software, researchers found.

From "Tech helps teach complex reading skills," *eSchoolNews* online, May 2006.
